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SHORT COMMUNICATION

Reconsidering what enclosure and exclosure mean in restoration ecology

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There is ambiguity in the use of the terms "enclosure" and "exclosure" in describing the passive method used for the restoration of degraded ecosystems. We argue that in the context of ecological restoration, the term enclosure is generally more appropriate to use than exclosure. Unlike exclosure, the term enclosure focuses on the degraded area to be restored, does not exclude selective permeability of external factors, and potentially accommodates local people's livelihood needs. However, the term exclosure is appropriate to use in the case of experimental exclosures or management of restoration sites which explicitly exclude specific disturbance factors.

Key words: degraded ecosystems, disturbance factors, human intervention, natural regeneration, rehabilitation

Conceptual Implications

- In the context of ecological restoration, the term area enclosure is generally more appropriate to use than area exclosure.
- The term area exclosure is appropriate to use in the case of experimental exclosures or management of restoration sites which have the objective of excluding specific disturbance factors. In such cases, however, the factors that will be excluded should be explicitly mentioned.

Some authors use the term area enclosure to describe the passive method used for restoration of degraded ecosystems, others prefer the term area exclosure (Aerts et al. 2009), and there are also authors who use the two terms interchangeably—this creates confusion on the selection and use of the correct term. Ostensibly, the two terms are not synonymous. Area enclosures are degraded lands that are protected from human and livestock intrusions for the purpose of rehabilitation mainly through natural ecological processes (Mengistu et al. 2005; Nedessa et al. 2005; Park et al. 2013; Gebrehiwot & Veen 2014). Although area exclosure has similar objectives as area enclosure, it emphasizes the exclusion of external disturbance factors (Aerts et al. 2009; Bongers & Tennigkeit 2010; Mekuria & Veldkamp 2012) that lead to ecosystem degradation. In order to clarify the ambiguity and misconception in the use of these terms, we assessed the strength and limitations or shortcomings of both terms.

Aerts et al. (2009) have discussed the confusion and misunderstanding in the use of these two terms and attempted to clarify their meanings. In the article, they recommend the term exclosure for rehabilitation of degraded sites that involve excluding of unwanted species or practices. In contrast to the recommendation by Aerts et al. (2009), we argue that in the context of ecological restoration, the term area enclosure is more appropriate to use than area exclosure for the following reasons:

1. The term area enclosure focuses on the area to be restored, whereas area exclosure focuses on the exclusion of external disturbance factors. The main aim for the establishment of area enclosure is for restoration of a degraded site and the fact that the term exclosure does not focus on the area to be restored is a major shortcoming. Furthermore, the term area enclosure implicitly implies exclusion of external disturbance factors, and hence, this term addresses both the focus on the area to be restored and exclusion of disturbance factors.
2. The area enclosure should allow entrance of the native fauna and even attract seed dispersing animals in order to enhance the natural regeneration of the flora and speed up the restoration process. Furthermore, the enclosed site may require human interventions to carry out activities, such as enrichment planting, weeding, reintroduction of the native fauna, control/eradication of alien species, and so on. In other words, the enclosed area needs to be permeable to organisms that enhance the biotic community within it and human intervention may be necessary for speeding up the natural succession and enrichment of the biodiversity. The term area enclosure does not exclude permeability for selected organisms and human intervention, while area exclosure projects a sense of impermeability.
3. In many developing countries, local people require short-term benefits from the enclosed areas, in the form of cut-and-carry grass, hanging bee hives on trees, and

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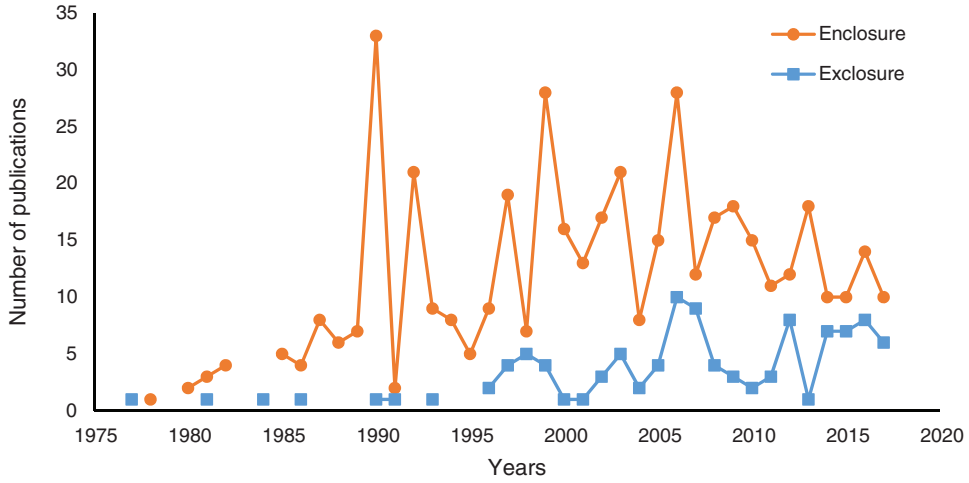

Figure 1. The number of articles using the term enclosures versus exclosure from 1977 to 2017. The data for the graph were obtained by searching of terms in SpringerLink using the key words "[area enclosure/exclosure] + [restoration or rehabilitation]."

even harvesting of the juvenile trees. Striking a fine balance between the environmental restoration and local people's livelihood needs is imperative. Hence, selective permeability of even potential disturbance factors is necessary to attain local people's support which is crucial for the sustainability of a restoration endeavor. In this regard, the concept of area exclosure by implying the prohibition of selective permeability does not seem to accommodate local people's livelihood needs.

4. The term exclosure by implying "exclusion" or "off limit" area, may have a negative connotation for the local people living in the vicinity of a restoration site. Consequently, the unfavorable perception may contribute to lack of participation, support for the rehabilitation activities, and long-term commitment by local communities. It has been shown by a substantial number of studies that language has intimate relationship with people's perception (Klemfuss et al. 2012). Hence, to avoid misunderstanding by the various stakeholders, the importance of choosing the right terms in the planning and implementation of rehabilitation projects should not be underestimated.
5. If the term area exclosure is used, for the sake of clarity it is necessary to list the disturbance factors that should be excluded. Moreover, the factors that need to be allowed or excluded from the enclosed area change through time and the list of factors should also change accordingly. Listing of such factors can be a cumbersome task, which is not necessary to do if the term area enclosure is used.

However, the term area exclosure is appropriate to use in the case of experimental exclosures or management of restoration sites, which have the objective of excluding specific disturbance factors (Witt et al. 2011; Loydi et al. 2012; Rong et al. 2014; Chen & Tang 2016; Qasim et al. 2017). In such cases, however, the factors that will be excluded should be explicitly mentioned.

Generally, the term enclosure has been used more widely than exclosure in different academic fields in relation to restoration or rehabilitation activities for the last four decades (Fig. 1).

In conclusion, because the term area enclosure focuses on the degraded area to be restored, does not exclude selective permeability of some external factors (affecting positively or negatively the restoration process), and potentially accommodates local people's livelihood needs, it is generally more appropriate to use than the term area exclosure in the context of ecological restoration.

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